Journal of Attention Disorders
http://jad.sagepub.com/

Is ADHD a Risk Factor for High School Dropout? A Controlled Study

Ronna Fried, Carter Petty, Stephen V. Faraone, Laran L. Hyder, Helen Day and Joseph Biederman

Journal of Attention Disorders published online 4 February 2013
DOI: 10.1177/1087054712473180

The online version of this article can be found at:
http://jad.sagepub.com/content/early/2013/02/03/1087054712473180

Published by:
SAGE
http://www.sagepublications.com

Additional services and information for *Journal of Attention Disorders* can be found at:

Email Alerts: http://jad.sagepub.com/cgi/alerts

Subscriptions: http://jad.sagepub.com/subscriptions

Reprints: http://www.sagepub.com/journalsReprints.nav

Permissions: http://www.sagepub.com/journalsPermissions.nav

>> OnlineFirst Version of Record - Feb 4, 2013

What is This?

Journal of Attention Disorders
XX(X) 1–7
© 2013 SAGE Publications
Reprints and permission:
sagepub.com/journalsPermissions.nav
DOI: 10.1177/1087054712473180
http://jad.sagepub.com
SAGE

Is ADHD a Risk Factor for High School Dropout? A Controlled Study

Ronna Fried[1,2], Carter Petty[1], Stephen V. Faraone[3], Laran L. Hyder[1], Helen Day[1], and Joseph Biederman[1,2]

Abstract

Objective: This study examined whether ADHD was an independent contributor to grade retention when adjusting for IQ, learning disorders, and social class. **Method:** Outcome data was from participants in studies at Massachusetts General Hospital (*n* = 404 ADHD, *n* = 349 controls) who underwent psychiatric interviews, socioeconomic status measures, and IQ testing. **Results:** 28% of individuals with ADHD repeated a grade compared with 7% of controls ($p < .001$). Among participants with ADHD, social class, and IQ were significant predictors of high school dropout or repeated grade. An interaction effect of ADHD and gender was also found with females with ADHD having a higher risk ratio for repeated grade/dropout compared with males with ADHD. **Conclusion:** Participants with ADHD were significantly more likely to repeat a grade, adjusting for all other variables indicating the critical importance of early identification of ADHD to help mitigate adverse educational outcomes. *(J. of Att. Dis. 2012; XX(X) 1-XX)*

Keywords

ADHD, adolescence, dropout

Every year in the United States, about 1.2 million students fail to graduate from high school on time with their peers (Alliance for Excellent Education, 2007). This termination of education has been shown to have severe adverse life-course consequences for these individuals such as poorer health, greater demand on social welfare entitlements (Freudenberg & Ruglis, 2007), lowear standard of living, and impaired social mobility (Kessler, Foster, Saunders, & Stang, 1995). In contrast, not only do high school graduates go on to earn higher wages but they also live longer (Muennig, 2005) and are less likely to commit crimes (Raphael, 2004) or rely on government health care (Muennig, 2005).

In addition to early termination of education, equally worrisome is the adverse societal impact of grade retention. Jimerson (1999) followed a sample of retained students, low achieving but promoted students, and control students for 21 years. In comparison with a group of low achieving but promoted students, the retained students were more likely to have lower levels of academic adjustment at the end of 11th grade, were more likely to drop out of high school by the age of 19, were less likely to receive a diploma by age 20, were less likely to be enrolled in a postsecondary education program, received lower education/employment status ratings, were paid less per hour, and received poorer employment competence ratings at age 20 (Jimerson, 1999). Similarly, Rumberger and Larson (1998) examined several variables associated with student mobility and high school dropout. Early grade retention emerged as a significant predictor of failure to complete high school (Rumberger & Larson, 1998). Compared with nonretained students, those retained prior to eighth grade were more than four times as likely not to complete high school or to receive a GED. Given the high morbidity and disability associated with grade retention and failing to complete secondary education, it is important to identify modifiable risk factors, so as to inform and motivate intervention efforts.

While the causes of school failure and high school dropout are multifactorial and heterogeneous, to have an impact on this important public health issue, it is critical to investigate potentially modifiable risk factors. One potentially modifiable risk factor that has been consistently associated with educational deficits is ADHD. Many studies of children and adults and from clinical and epidemiologic samples show that ADHD is associated with school failure, poor grades, grade retention, and academic and occupational under

---

[1] Massachusetts General Hospital, Boston, USA
[2] Harvard Medical School, Cambridge, MA, USA
[3] State University of New York Upstate Medical University, Syracuse, USA

Corresponding Author:
Ronna Fried, Clinical and Research Programs in Pediatric Psychopharmacology and Adult ADHD, Massachusetts General Hospital, Warren 705; 55 Fruit Street, Boston, MA 02114-3139, USA
Email: rfried@partners.org

attainment (Barkley, Fischer, Smallish, & Fletcher, 2006; Biederman et al., 1993; Biederman et al., 1994; Biederman et al., 1996; Biederman et al., 1999; Biederman, Faraone et al., 2006; Faraone, Biederman, Doyle, et al., 2006; Faraone, Biederman, Spencer, et al., 2006). In one study (Biederman et al., 2004), participants with ADHD were shown to be 2.7 times more likely to repeat a grade (22.9%) than non-ADHD controls (10.0%). Likewise, Barbaresi, Katusic, Colligan, Weaver, and Jacobsen (2007) demonstrated an association between ADHD and poor long-term school outcomes, including grade retention (3 times more likely for participants with ADHD) and high school dropout (2.7 times more likely for participants with ADHD). Kessler et al. (1995) estimated that more than 7.2 million people in the United States prematurely terminated their education because of early-onset psychiatric disorders (including ADHD), and only a small fraction would later complete either high school or be enrolled in a postsecondary education program. A very recent study (Breslau, Miller, Joanie Chung, & Schweitzer, 2011) in 29,662 participants showed that ADHD predicted failure to achieve on-time graduation from high school and that ADHD participants had a distinct pathway to failure to graduate. However, because intelligence, social class, and learning disorders are also risk factors for school failure and are also associated with ADHD, a thorough investigation of ADHD's contribution to academic failure needs to attend to these confounders.

The main aim of this study was to examine the impact of ADHD on grade retention and failure to complete high school attending to the confounders of IQ, social class, and learning disabilities. To this end, we used educational outcome data from three large case-control studies of ADHD. We hypothesized that ADHD would be an independent contributor to school failure. To the best of our knowledge, this is the most comprehensive study to isolate ADHD as a major factor for grade retention and failure to complete high school.

Method

Participants

Participants were ascertained from three studies conducted at the Clinical and Research Programs in Pediatric Psychiatry and Adult ADHD at Massachusetts General Hospital ("A Controlled Family Study of Boys with ADHD," "A Controlled Family Study of Girls ADHD," and "A Controlled Family Study of Adults with ADHD"). In the study of boys with ADHD, we recruited boy probands with (n = 140) and without (n = 120) ADHD, between the ages of 6 and 17 years. In the study of girls, we recruited girl probands with (n = 140) and without (n = 122) ADHD, between the ages of 6 and 17 years. The boys sample was reassessed 4 and 10 years after baseline. The girls sample was followed up 5 and 10 years after baseline. As previously reported, children participating in the boys (Biederman et al., 1992; Biederman et al., 1996; Biederman, Monuteaux, et al., 2006) and girls (Biederman et al., 2008) studies were ascertained from psychiatric and pediatric sources. We selected controls from outpatients receiving routine physical examinations at pediatric medical clinics. In the adult study (Faraone, Biederman, Spencer, et al., 2006), we recruited male and female adult participants between the ages of 18 and 55 with (n = 219) and without (n = 147) ADHD. We have chosen age 55 in all of our adult studies to avoid the confounder of cognitive decline. Across all studies, potential probands were excluded if they had been adopted, if their nuclear family was not available, if they had major sensorimotor handicaps (paralysis, deafness, blindness), if they had psychosis or autism, or if they were unable to participate due to language barriers or an estimated IQ < 80. After complete description of the study to the participants, all adult participants provided written consent and parents provided written informed consent for their children, who provided written assent. The IRB at Massachusetts General Hospital approved this study. For the boys and girls studies, we used data from the follow-up assessments to determine secondary school completion status. If a participant was lost to follow-up prior to reaching the age of 19, that participant was excluded from the present analyses because completion status could not be determined with certainty. Thus, the final sample for this report consisted of 753 participants (188 and 203 from the boys and girls studies, respectively, and 362 from the adult study). Original data were collected from 1988 to 2007.

Materials and Procedure

The same assessment methodology was used in all studies. Psychiatric assessments relied on the Kiddie Schedule for Affective Disorders and Schizophrenia–Epidemiologic Version (K-SADS-E; Orvaschel, 1994) for participants less than 18 years of age and the Structured Clinical Interview for *DSM-III-R* (SCID; Spitzer, Williams, Gibbon, & First, 1992; supplemented with modules [e.g., CD] from the K-SADS-E to assess childhood diagnoses) for participants aged 18 and above. For participants aged less than 18 years, diagnoses were based on direct interviews with the mothers and the offspring, except for children less than 12 years who were not interviewed directly. For participants 18 years of age and above, diagnoses were based on direct interviews with the participant. Diagnoses were considered positive if diagnostic criteria were unequivocally met. A committee of board-certified child and adult psychiatrists resolved diagnostic uncertainties. Diagnoses were considered positive only if a consensus was achieved that criteria were met to a degree that would be considered clinically meaningful.

The interviewers were blind to the participant's baseline ascertainment group, the ascertainment site, and all prior assessments. The interviewers had undergraduate degrees in psychology and were extensively trained and supervised. First, they underwent several weeks of classroom style training, learning interview mechanics, diagnostic criteria, and coding algorithms. Then, they observed interviews by experienced raters and clinicians. They subsequently conducted at least six practice (nonstudy) interviews and senior interviewers observed them conducting at least three study interviews. We computed kappa coefficients of agreement by having experienced, board-certified child and adult psychiatrists and licensed clinical psychologists diagnose participants from audiotaped interviews. Based on 500 assessments from interviews of children and adults, the median kappa coefficient was 0.98. Kappa coefficients for individual diagnoses included the following: ADHD (0.88), conduct disorder (1.0), major depression (1.0), mania (0.95), separation anxiety (1.0), agoraphobia (1.0), panic (0.95), substance use disorder (1.0), and tics/Tourette's (0.89).

A committee of board-certified child and adult psychiatrists who were blind to the participant's ADHD status, referral source, and all other data resolved diagnostic uncertainties. Uncertainties arose in a minority of comorbid disorders, but never for ADHD. Diagnoses presented for review were considered positive only when the committee determined that diagnostic criteria were met to a clinically meaningful degree. We estimated the reliability of the diagnostic review process by computing kappa coefficients of agreement for clinician reviewers. For these diagnoses, the median reliability between individual clinicians and the review committee assigned diagnoses was 0.87. Kappa coefficients for individual diagnoses included the following: ADHD (1.0), conduct disorder (1.0), major depression (1.0), bipolar (0.78), separation anxiety (0.89), agoraphobia (0.80), panic (0.77), substance use disorder (1.0), and tics/Tourette's (0.68).

Demographic and Academic Variables

Socioeconomic status (SES) was measured with the 5-point Hollingshead scale (Hollingshead, 1975). Social class measurement ranges from 1 through 5; 1 = *most affluent social class*, 5 = *least affluent*. Low SES was defined as the three lowest levels on the 5-point scale. IQ was estimated from the Block Design and Vocabulary subtests of the *Wechsler Adult Intelligence Scale–Revised* (WAIS-R; Wechsler, 1981). Academic achievement was assessed with the Reading and Arithmetic tests of the Wide Range Achievement Test–Revised (WRAT-R; Jastak & Jastak, 1985). To assess the presence of learning disabilities, we used the procedure recommended by Reynolds (1984) and others (Frick et al., 1991), which we have used previously (Faraone, Biederman, Monuteaux, Doyle, & Seidman, 2001) that utilizes a discrepancy model between IQ and achievement. We collected data about each participant's lifetime history of grade retention, placement in special classes, receiving academic tutoring or extra help, and years of education completed.

Statistical Analysis

First, we compared probands with and without ADHD on demographic characteristics, using Pearson chi-square tests and *t* tests for categorical and dimensional variables, respectively. Second, we categorized all participants assessed at or after the age of 19 according to their secondary school course based on completion status and lifetime history of school failure indexed through repeated grade (i.e., completed secondary school and never repeated a grade vs. dropped out or repeated a grade). To test the association between ADHD and high risk of failure to complete secondary school, we estimated a logistic regression model with dropout/repeated grade status as the dependent variable and ADHD status and any confounding factors as the independent variables. To determine the predictors of secondary school dropout/repeated grade, we first tested any interaction effects of ADHD and other predictors in logistic regression models predicting dropout/repeated grade. Then, using a multivariate logistic regression model, we tested the dropout/repeated grade status as the dependent variable and ADHD, disruptive behavior disorders (conduct disorder and/or oppositional-defiant disorder), mood disorders (major depression and/or bipolar disorder), multiple (≥ 2) anxiety disorders, substance use disorders (alcohol or drug abuse or dependence), full-scale IQ estimate, learning disability (math or reading), age, sex, and study as the independent variables. The psychiatric comorbidity variables were coded positive only if the participant reported a lifetime history of the disorder(s) in question prior to age 19. Participants who reported the disorder onset occurring on or after age 19 were coded negative for that variable. All statistical tests were two-tailed, and alpha was set at .05.

Results

There were no significant differences between participants with and without ADHD on sex. However, the ADHD group had an older mean age and a lower mean social class (see Table 1).

The proportion of participants with and without ADHD who failed to complete high school or repeated a grade were 29.2% ($n = 118$) and 7.7% ($n = 27$), respectively ($p < .001$). We tested the association between repeated grade/dropout and ADHD status, controlling for study of origin, age, and social class. After controlling for these variables, we found that participants with ADHD were significantly more likely to have repeated a grade or failed to complete

Table 1. Demographic Characteristics

Demographic characteristic	Controls (n = 349) *n*	Controls %	ADHD (n = 404) *n*	ADHD %	Test statistic	*p* value
Male (% male)	163	47	206	51	$\chi^2(1) = 1.38$	.241
Study					$\chi^2(2) = 9.29$	.010
Boys	96	28	92	23		
Girls	106	30	97	24		
Adult	147	42	215	53		
	M	*SD*	*M*	*SD*		
Age (years)	27.2	7.3	30.7	10.1	$t(751) = -5.37$	<.001
Socioeconomic status	1.8	0.7	2.1	1.0	$t(712) = -4.91$	<.001
IQ	115.3	12.4	108.2	14.8	$t(751) = 7.09$	<.001

Table 2. Details of Multivariate Model Predicting Repeated Grade/High School Dropout

Predictor	Odds ratio, 95% confidence interval	*z* statistic	*p* value
ADHD	3.13 [1.79, 5.48]	4.00	<.001
Low socioeconomic status	2.20 [1.37, 3.53]	3.25	.001
IQ < 100	2.94 [1.84, 4.69]	4.52	<.001
Disruptive disorders	1.51 [0.90, 2.52]	1.57	.12
Mood disorders	1.31 [0.79, 2.17]	1.06	.29
Anxiety disorders	0.73 [0.43, 1.22]	−1.19	.23
Substance use disorders	0.78 [0.49, 1.22]	−1.09	.28
Learning disability	1.28 [0.75, 2.20]	0.90	.37

Note: Predictors are also included in the model: study of origin, sex, and age.

high school compared with participants without ADHD (odds ratio [OR], 95% confidence interval [CI] = 4.8 [2.9, 7.7], $z = 6.28$, $p < .001$).

We found a significant interaction effect of ADHD and gender ($z = -2.67$, $p = .007$). Specifically, females with ADHD had a higher risk ratio for repeated grade/dropout (3% in controls vs. 28% in ADHD, OR = 11.8, 95% CI = [5.0, 28.2], $p < .001$) compared with males with ADHD (13% in controls vs. 30% in ADHD, OR = 2.9, 95% CI = [1.7, 5.0], $p < .001$). There were no other significant interaction effects of ADHD status and other risk factors.

As shown in Table 2, ADHD, social class, and IQ were significant predictors of high school dropout or repeated grade among participants with ADHD. Specifically, participants with ADHD were significantly more likely to repeat a grade or drop out of school, adjusting for all other variables (adjusted probabilities of repeated grade/dropout: ADHD = 26.5% vs. non-ADHD = 6.4%) and vice versa: independent of ADHD status, social class, and IQ were predictors of high school dropout or repeated grade.

Discussion

We found that participants with ADHD were significantly more likely to have repeated a grade or failed to complete high school compared with participants without ADHD, even after adjusting for social class, IQ, and learning disability (math or reading; adjusted probabilities of repeated grade/dropout: ADHD = 26.5% vs. non-ADHD = 6.4%). While social class and IQ were also potent, independent predictors of grade retention and failure to complete high school, ADHD is more easily treatable and modifiable. These findings confirm the study hypothesis that ADHD is an independent significant risk factor for grade retention and early educational termination, stressing that early identification and early intervention of this disorder are critical to averting these harmful outcomes.

Our findings that ADHD is a risk factor for grade retention and failure to complete high school are consistent with results from large-scale epidemiological studies documenting the same (Biederman et al., 2004; Kessler et al., 2006). These results are also consistent with Barbaresi et al.'s (2007) findings where long-term school outcomes for children with and without ADHD were studied in a population-based study. They found that participants with ADHD were 2.7 times more likely to drop out before high school graduation and non-ADHD controls.

Roderick (1994) highlighted the importance of grade retention as a predictor of compromised education course. These latter investigators used a cohort of youths from an urban school system to examine whether and how grade retention influenced graduation outcomes. In that study, the odds of dropping out from high school were, on average, 2.24 times greater across risk periods for students who repeated a grade from first grade to sixth grade than for nonretained participants. For participants who were retained more than once, the odds of dropping out from high school were 3 times higher across risk periods when compared with nonretained participants. In addition, early and late grade retentions were associated with significant increases in high school dropouts.

Similarly, Jimerson, Anderson, and Whipple (2002) conducted a systematic review of the literature concerning the association between high school dropout status and grade retention. All reviewed studies that included grade retention as a potential predictor of dropping out from high school demonstrated an association between the two variables. Several of the reviewed studies reported grade retention to be the strongest predictor of later dropout states. Taken together, these findings, along with those of the extant literature and community surveys, clearly indicate that individuals with ADHD are at high risk of grade retention and failing to complete high school.

In our analysis, a novel outcome was the significant interaction effect of ADHD and gender as most studies (Chapman, Laird, & Kewal-Ramani, 2010) have found that boys are generally more likely to drop out of school than girls. However, in our study, the same percentage of males and females with ADHD failed to complete high school. Based on the rates of controls, this finding indicates that ADHD increases the risk of dropout by tenfold, whereas for boys, the ratio was less than threefold, indicating dropout for girls with ADHD is of high significance.

Our findings that ADHD is an independent major risk factor for grade retention and early termination of education have very important clinical and public health implications. Considering that the average age of onset of ADHD is in the preschool years (Wilens et al., 2002) and that it is a very treatable disorder, these findings should encourage clinicians to help identify students with ADHD and target them for early intervention efforts. Considering that ADHD is a highly modifiable risk factor for a compromised educational course, these findings have large public health significance as a compromised educational course profoundly affects the individual, the family, and society at large. Recent findings document that many high school dropouts attribute negative attitudes about staying in school to symptoms that may well be indicative of undiagnosed ADHD (Bridgeland, DiIulio, & Morison, 2006), adding to the likelihood that diagnosing ADHD in younger grades could be beneficial to ameliorating this public health problem. Thus, early screening in schools for ADHD could be an important preventative measure for grade retention and thus curbing dropout rates.

These results need to be viewed in light of some methodological limitations. The majority of participants in our sample were Caucasian-referred participants, thus our results may not be generalizable to minority groups and community samples.

Conclusion

With these limitations in mind, this study found that ADHD makes a significant contribution to grade retention and high school dropout in youth independently of IQ, social class, and learning disabilities. Although IQ and social class were also found to independently contribute to these risks, these risk factors are less modifiable than ADHD. These findings stress that early identification and early intervention efforts aimed at children are critical to help mitigate adverse educational outcomes.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: In the past year, Dr. Stephen Faraone received consulting income and research support from Shire, Otsuka, and Alcobra and research support from the National Institutes of Health (NIH). In previous years, he received consulting fees or was on Advisory Boards or participated in continuing medical education programs sponsored by Shire, McNeil, Janssen, Novartis, Pfizer, and Eli Lilly. Dr. Faraone receives royalties from books published by Guilford Press: *Straight Talk about Your Child's Mental Health* and Oxford University Press: *Schizophrenia: The Facts*.

Dr. Joseph Biederman is currently receiving research support from the following sources: Elminda, Janssen, McNeil, and Shire. In 2012, he received an honorarium from the MGH Psychiatry Academy for a tuition-funded CME course. In 2011, he gave a single unpaid talk for Juste Pharmaceutical Spain, received honoraria from the MGH Psychiatry Academy for a tuition-funded CME course, and received an honorarium for presenting at an international scientific conference on ADHD. He also received an honorarium from Cambridge University Press for a chapter publication. He received departmental royalties from a copyrighted rating scale used for ADHD diagnoses, paid by Eli Lilly, Shire, and AstraZeneca; these royalties are paid to the Department of Psychiatry at MGH. In 2010, he received a speaker's fee from a single talk given at Fundación Dr. Manuel Camelo A.C. in Monterrey Mexico. Dr. Biederman provided single consultations for Shionogi Pharma Inc. and Cipher Pharmaceuticals Inc.; the honoraria for these consultations were paid to the Department of Psychiatry at the MGH. He received honoraria from the MGH Psychiatry Academy for a tuition-funded CME course. In previous years, he received research support, consultation fees, or speaker's fees for/from the following additional sources: Abbott, Alza, AstraZeneca, Boston University, Bristol Myers Squibb, Celltech, Cephalon, Eli Lilly and Co., Esai, Fundacion Areces (Spain), Forest, Glaxo, Gliatech, Hastings Center, Janssen, McNeil, Medice Pharmaceuticals (Germany), Merck, MMC Pediatric, NARSAD, NIDA, New River, NICHD, NIMH, Novartis, Noven, Neurosearch, Organon, Otsuka, Pfizer, Pharmacia, Phase V Communications, Physicians Academy, The Prechter Foundation, Quantia Communications, Reed Exhibitions, Shire, the Spanish Child Psychiatry Association, The Stanley Foundation, UCB Pharma Inc., Veritas, and Wyeth.

In the past, Dr. Ronna Fried has received honoraria from Shire. All other authors have nothing to disclose.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was supported by the MGH Pediatric Psychopharmacology Philanthropy Fund.

References

Alliance for Excellent Education. (2007). *The high cost of high school dropouts: What the nation pays for inadequate high schools*. Washington, DC: Author.

Barbaresi, W. J., Katusic, S. K., Colligan, R. C., Weaver, A. L., & Jacobsen, S. J. (2007). Long-term school outcomes for children with attention-deficit/hyperactivity disorder: A population-based perspective. *Journal of Developmental & Behavioral Pediatrics*, *28*, 265-273.

Barkley, R. A., Fischer, M., Smallish, L., & Fletcher, K. (2006). Young adult outcome of hyperactive children: Adaptive functioning in major life activities. *Journal of the American Academy of Child & Adolescent Psychiatry*, *45*, 192-202.

Biederman, J., Faraone, S., Milberger, S., Guite, J., Mick, E., Chen, L., & Perrin, J. (1996). A prospective 4-year follow-up study of attention-deficit hyperactivity and related disorders. *Archives of General Psychiatry*, *53*, 437-446.

Biederman, J., Faraone, S. V., Keenan, K., Benjamin, J., Krifcher, B., Moore, C., & Tsuang, M. T. (1992). Further evidence for family-genetic risk factors in attention deficit hyperactivity disorder. Patterns of comorbidity in probands and relatives in psychiatrically and pediatrically referred samples. *Archives of General Psychiatry*, *49*, 728-738.

Biederman, J., Faraone, S. V., Mick, E., Williamson, S., Wilens, T. E., Spencer, T. J., & Zallen, B. (1999). Clinical correlates of ADHD in females: Findings from a large group of girls ascertained from pediatric and psychiatric referral sources. *Journal of the American Academy of Child & Adolescent Psychiatry*, *38*, 966-975.

Biederman, J., Faraone, S. V., Spencer, T., Mick, E., Monuteaux, M., & Aleardi, M. (2006). Functional impairments in adults with self-reports of diagnosed ADHD: A controlled study of 1001 adults in the community. *Journal of Clinical Psychiatry*, *67*, 524-540.

Biederman, J., Faraone, S. V., Spencer, T., Wilens, T., Mick, E., & Lapey, K. A. (1994). Gender differences in a sample of adults with attention deficit hyperactivity disorder. *Psychiatry Research*, *53*, 13-29.

Biederman, J., Faraone, S. V., Spencer, T., Wilens, T., Norman, D., Lapey, K. A., & Doyle, A. (1993). Patterns of psychiatric comorbidity, cognition, and psychosocial functioning in adults with attention deficit hyperactivity disorder. *American Journal of Psychiatry*, *150*, 1792-1798.

Biederman, J., Monuteaux, M. C., Mick, E., Spencer, T., Wilens, T. E., Silva, J. M., & Faraone, S. V. (2006). Young adult outcome of attention deficit hyperactivity disorder: A controlled 10-year follow-up study. *Psychological Medicine*, *36*, 167-179.

Biederman, J., Monuteaux, M., Seidman, L., Doyle, A. E., Mick, E., Wilens, T., & Faraone, S. V. (2004). Impact of executive function deficits and ADHD on academic outcomes in children. *Journal of Consulting and Clinical Psychology*, *72*, 757-766.

Biederman, J., Petty, C. R., Monuteaux, M. C., Mick, E., Parcell, T., Westerberg, D., & Faraone, S. V. (2008). The longitudinal course of comorbid oppositional defiant disorder in girls with attention-deficit/hyperactivity disorder: Findings from a controlled 5-year prospective longitudinal follow-up study. *Journal of Developmental & Behavioral Pediatrics*, *29*, 501-507.

Breslau, J., Miller, E., Joanie Chung, W. J., & Schweitzer, J. B. (2011). Childhood and adolescent onset psychiatric disorders, substance use, and failure to graduate high school on time. *Journal of Psychiatric Research*, *45*, 295-301.

Bridgeland, J. M., DiIulio, J. J., & Morison, K. B. (2006). *The silent epidemic: Perspectives of high school dropouts*. A report by Civic Enterprises in association with Peter D. Hart Research Associates for the Bill & Melinda Gates Foundation, Washington, DC.

Chapman, C., Laird, J., & Kewal-Ramani, A. (2010). *Trends in high school dropout and completion rates in the United States: 1972–2008*. Washington, DC: National Center for Education Statistics of the U.S. Department of Education.

Faraone, S. V., Biederman, J., Doyle, A. E., Murray, K., Petty, C., Adamson, J., & Seidman, L. (2006). Neuropsychological Studies of Late Onset and Subthreshold Diagnoses of Adult ADHD. *Biological Psychiatry*, *60*, 1081-1087.

Faraone, S. V., Biederman, J., Monuteaux, M. C., Doyle, A. E., & Seidman, L. J. (2001). A Psychometric measure of learning disability predicts educational failure four years later in boys with attention deficit hyperactivity disorder. *Journal of Attention Disorders*, *4*, 220-230.

Faraone, S. V., Biederman, J., Spencer, T., Mick, E., Murray, K., Petty, C., & Monuteaux, M. C. (2006). Diagnosing adult attention deficit hyperactivity disorder: Are late onset and subthreshold diagnoses valid? *American Journal of Psychiatry*, *163*, 1720-1729.

Freudenberg, N., & Ruglis, J. (2007). Reframing school dropout as a public health issue. *Preventing Chronic Disease*, *4*(4), A107.

Frick, P. J., Lahey, B. B., Kamphaus, R. W., Loeber, R., Christ, M. A. G., Hart, E. L., & Tannenbaum, L. E. (1991). Academic underachievement and the disruptive behavior disorders. *Journal of Consulting and Clinical Psychology*, *59*, 289-294.

Hollingshead, A. B. (1975). *Four factor index of social status*. New Haven, CT: Yale University Press.

Jastak, J. F., & Jastak, S. (1985). *The Wide Range Achievement Test–Revised*. Wilmington, DE: Jastak Associates.

Jimerson, S. (1999). On the failure of failure: Examining the association between early grade retention and education and employment outcomes during late adolescence. *Journal of School Psychology*, *37*, 243-272.

Jimerson, S., Anderson, G., & Whipple, A. (2002). Winning the battle and losing the war: Examining the relation between grade retention and dropping out of high school. *Psychology in the School*, *39*, 441-457.

Kessler, R. C., Adler, L., Barkley, R., Biederman, J., Conners, C. K., Demler, O., & Zaslavsky, A. M. (2006). The prevalence and correlates of adult ADHD in the United States: Results from the national comorbidity survey replication. *American Journal of Psychiatry*, *163*, 716-723.

Kessler, R. C., Foster, C. L., Saunders, W. B., & Stang, P. E. (1995). Social consequences of psychiatric disorders, I: Educational attainment. *American Journal of Psychiatry*, *152*, 1026-1032.

Muennig, P. (2005, October). *Health returns to education interventions*. Paper prepared for the symposium on the Social Costs of Inadequate Education, Teachers College Columbia University.

Orvaschel, H. (1994). *Schedule for Affective Disorders and Schizophrenia for School-Age Children Epidemiologic Version* (5th ed.). Fort Lauderdale, FL: Nova Southeastern University, Center for Psychological Studies.

Raphael, S. (2004). *The socioeconomic status of black males: The increasing importance of incarceration*. Berkeley, CA: Goldman School of Public Policy, University of California.

Reynolds, C. R. (1984). Critical measurement issues in learning disabilities. *Journal of Special Education*, *18*, 451-476.

Roderick, M. (1994). Grade retention and school dropout: Investigating the association. *American Educational Research Journal*, *31*, 729-759.

Rumberger, R., & Larson, K. (1998). Student mobility and the increased risk of high school dropout. *American Journal of Education*, *107*, 1-35.

Spitzer, R. L., Williams, J. B., Gibbon, M., & First, M. B. (1992). The structured clinical interview for DSM-III-R (SCID). I: History, rationale, and description. *Archives of General Psychiatry*, *49*, 624-629.

Wechsler, D. (1981). *Manual for the Wechsler Adult Intelligence Scale–Revised*. San Antonio, TX: Psychological Corporation.

Wilens, T., Biederman, J., Brown, S., Tanguay, S., Monuteaux, M., Blake, C., & Spencer, T. J. (2002). Psychiatric comorbidity and functioning in clinically referred preschoolers and school aged youth with ADHD. *Journal of the American Academy of Child & Adolescent Psychiatry*, *41*, 262-268.

Bios

Ronna Fried, EdD, is codirector of neuropsychology and the director of paradigm development in the Pediatric Psychopharmacology Program at the Massachusetts General Hospital and instructor in psychiatry at Harvard Medical School.

Carter Petty, MA, is the senior biostatistician in the Pediatric Psychopharmacology Program at the Massachusetts General Hospital. He received his master's degree in statistics from Harvard University and a bachelor's degree in psychology from Stanford University.

Stephen V. Faraone, PhD, is the director of medical genetics research, professor of psychiatry and of neuroscience and physiology, and director of child and adolescent psychiatry research at SUNY Upstate Medical University. He also serves as senior scientific advisor to the pediatric psychopharmacology at MGH, as well as lecturer in psychiatry at Harvard Medical School.

Laran Hyder received a bachelor's degree from The University of Akron and is a research assistant in the Pediatric Psychopharmacology Program at the Massachusetts General Hospital.

Helen Day received a bachelor's degree from Wellesley College and is a research assistant in the Pediatric Psychopharmacology Program at the Massachusetts General Hospital.

Joseph Biederman is chief of the clinical and research programs in pediatric psychopharmacology and adult ADHD at the Massachusetts General Hospital, and professor of psychiatry at the Harvard Medical School. He is board certified in general and child psychiatry.